fifteen years of age, who will afterwards be engaged in trade, represent roughly the type of school in which continuation classes can best be carried on.

It is useless to make continued education of primary-school pupils compulsory without the provision and adequate equipment of schools for practical instruction in close relationship with the occupations of the pupils. The schools should thus do something to relieve the monotony and extend the outlook of the young workman who, on account of the minute subdivision of manual labour, may spend his life upon one small detail of some product or process, and learn nothing beyond it. Industrial advance demands the production of intelligent and adaptable types of workmen; and practical continuation classes offer a means of training them which is impossible under modern conditions of manual work. Mr. J. C. Smail, organiser of trades schools for boys under the London County Council Education Committee, has recently studied in Germany the compulsory system of continued education for boys from fourteen to eighteen years of age; and we may appropriately give here a statement of the conclusions arrived at by him with regard to such schools, as they have a direct bearing upon the foregoing remarks, which were written before the report was published:—

(1) There has been, broadly speaking, a difference in ideals between Germany and Britain in the organisation of technical courses. Germany is aiming at benefiting the nation by training properly all the workers through definitely specialised courses. Britain has organised so that individuals may secure what they think best for their own advancement.

(2) The fundamental basis of any course of study for technical students must be their trade or employment. If this is recognised and acted on in the preliminary years from fourteen to eighteen there is little danger of work at more advanced stages, even if irregularly organised, being ineffective.

(3) Germany is aiming at making good citizens and has realised that a good citizen must be a good workman.

(4) Germany has come to believe that workshop training alone is insufficient to make a sound industrial nation; that it must be reinforced by adequate education specialised to trades.

(5) This specialised education must include specialised calculations, technology, drawing, and citizenship. Munich also believes in trade work in the compulsory schools, Berlin does not.

(6) Citizenship must be taught to enable the worker to recognise his individual position in the State, his position with respect to his employer and his fellow-workmen, his family and social duties, the relative position of his trade in his own country, and in the world's commerce and industry.

R. A. Gregory.

CYTOLOGICAL ASPECTS OF HEREDITY.

THE current number of the *Quarterly Journal of Microscopical Science* (vol. lix., part 4) will be of exceptional interest to students of heredity from the cytological point of view. Dr. L. Doncaster contributes a very useful review of the present state of the evidence with regard to the material basis of hereditary transmission and sex-determination, under the title, "Chromosomes, Heredity and Sex." He concludes that the arguments in favour of the view that Mendelian characters are determined by chromosomes, though very strong indirectly, are lacking in direct evidence. The direct evidence of a relation between chromosomes and sex-determination is much stronger, and various cases are discussed. The phenomena of sex-limited inheritance, now known to occur in various groups of the animal kingdom, taken in conjunction with this relation, afford strong support to the view that the chromosomes play a very important part in the transmission of Mendelian characters, although the part played by the cytoplasm must also be taken into account. With regard to sex-determination difficulties arise in connection with the fact that this has been shown in certain cases to be modifiable by environmental conditions, and it therefore seems probable that the sex chromosome is associated with a particular type of cell-metabolism, which in turn is responsible for sex-determination.

A very important contribution to the discussion is made by Dr. R. R. Gates and Miss Nesta Thomas in "A Cytological Study of Œnothera mut. lata and Œ. mut. semilata in Relation to Mutation." These authors find that in the "mutants" of the evening primrose known as "lata" and "semilata," fifteen chromosomes always occur instead of the normal fourteen. The peculiar characters of these mutants are thus shown to be associated with the presence of an extra chromosome, which they are believed to have acquired by the abnormal distribution of both chromosomes of one pair to the same daughter-nucleus in the reduction division, the actual occurrence of such abnormal distribution having previously been demonstrated by Dr. Gates. The authors maintain that mutations and Mendelian hybrids are not of the same nature but must be contrasted with one another, the former owing their origin to germinal changes (*e.g.* the presence of an extra chromosome), and the latter to recombinations of the parental characters. Dr. Gates adds a useful note on the meaning of the term "mutation," and the difference between "mutations" and "fluctuations."

THE CURRENTS IN BELLE ISLE STRAIT.[1]

THE behaviour of tidal streams and currents in Belle Isle Strait, described by Dr. Dawson, Superintendent of Tidal Surveys to the Canadian Government, in a number of reports, the latest of which are before us, affords an example of the manner in which the various elements in a complex current may be distinguished one from the other. As the same may apply to other straits where the conditions are similar it should, therefore, be of more than local interest. The current in the strait is primarily tidal in character, and under normal conditions it will turn regularly; the flood running westward, and the ebb eastward with equal velocity. When, however, the moon is in high declination the resulting diurnal inequality causes one flood and one ebb in the day to be twice as strong as the other; the difference being much greater than that between ordinary or average springs and neaps.

In addition to the tidal fluctuations, the water has a tendency to make through the strait in one direction more than the other, thus causing a continuous gain to eastward or westward, as the case may be. The overbalance in one direction which is superimposed upon the usual tide elements to which the term element of *dominant flow* is given, introduces complications, because larger in relation to the strength of the tidal streams, especially at neaps when weak. It may, in fact, be so strong as to reverse the ordinary tidal streams or prevent them from turning, although the fluctuation in velocity be well marked.

The dominant flow, it is stated, cannot be attributed to local wind, because wind would produce merely a surface drift, whereas the dominant flow is that of the whole body of the water. It is, however, apparently

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[1] The Currents in the Gulf of St. Lawrence. By Dr. W. Bell Dawson. (Ottawa: Government Printing Bureau, 1913.)

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due to meteorological causes affecting, it is suggested, changes in the Labrador current or in the volume of water passing into the Gulf of St. Lawrence, occasioned by the distribution of barometrical pressure. The highest tides have been found to occur with winds from between north-east or north-west, and the lowest with winds from west or south-west.

The probable direction of the dominant flow may be inferred from the general weather conditions of the region, and from the presence or absence of floating icebergs in the strait; there being, as a rule, icebergs in the offing of the strait. With a dominant westward flow, bergs afloat in the offing will drift into the strait, whereas with a dominant eastward flow the strait is free from floating bergs; for the icebergs near either shore are certain to be aground and are therefore no guide; they may have been there for weeks. Even in the middle of the strait a berg, if large enough, may ground.

Briefly, the best indications are as follow:—The strait being clear of floating bergs, the barometer moderately high and rising or high and steady, a dominant flow to eastward is probable. There being floating bergs in the strait, and a barometric depression passing southward, indicated by broken weather, a dominant flow to westward is probable; and after a gale from north or north-west certain. The temperature of the water as an indication cannot be relied on.

On the whole the westward flow probably predominates in May and June; and, although less pronounced, the eastward flow is the more frequent in summer; while from September onwards the flow is more to the westward than to the eastward.

As regards the velocity of the current, when the moon is at its maximum declination and there is no dominant flow; at spring tides the strong flood and ebb velocity is 2·27 nautical miles; the weak flood and ebb 0·72 mile. At neaps, strong flood and ebb, 1·04 miles; weak flood and ebb, 0·32 mile. The greatest rates of dominant flow, observed during two seasons, considered separately, were:—Westward average, 1·69 nautical miles running continuously, but fluctuating from 2·65 miles to 0·64 with flood and ebb; eastward average, 1·30 miles to 0·50 mile with ebb and flood.

Under combined conditions the highest velocities observed were:—Westward during flood period, 3·45 nautical miles; eastward during ebb, 2·83 miles.

SUPERSTITIONS RELATING TO WEATHER.

IN an interesting article in the February number of *Himmel und Erde,* Prof. G. Hellmann, director of the Berlin Meteorological Institute, discusses some of the widespread notions generally included in the above heading. At the same time, he points out that some theories long believed in, although afterwards proved to be false, cannot be classed among superstitions.

The subject is divided into three parts, but we can here only refer to a very few typical cases. (1) That relating to the character and causes of meteorological phenomena. This takes us back to mythological times when all the forces of nature were personified; even to-day Jupiter Pluvius is frequently spoken of. Many of the present-day ideas still savour of superstition, *e.g.* the occurrence of thunderbolts, the *return* of a thunderstorm at a later time of the same day, and the belief in equinoctial gales. With regard to the latter, the author refers the idea to Greek and Roman origin, as such storms are prevalent in the Mediterranean regions.

(2) The possibility of predicting weather for any period. Many old sayings have been handed down from father to son; while most of them are based on unsound conclusions, some of them are good, *e.g.* the strengthening cold with lengthening days, the coloration of morning and evening sky, etc. Of modern sayings, that relating to the "ice-saints" (May 11–13) has been attributed both to cosmical and terrestrial sources. Investigations have shown that cold periods in May may occur in any of the three decades (especially the second), but cannot be referred to any special days. The moon's influence is still believed in by millions of people, notwithstanding the proofs given to the contrary.

(3) The possibility of influencing the weather and of making any special kind. This idea extends back to earliest times, and is still prevalent in some parts. One of the principal objects was the warding off of hail- and thunder-storms. Modern hail-shooting has proved to be ineffectual, but it will in all probability return later on in another form. The practice of bell-ringing for the prevention of thunderstorms was at one time much favoured, and is still in vogue in a few alpine districts. The belief in the possibility of making weather is very old, but its origin cannot be exactly fixed. Unsuccessful attempts at rain-making have frequently been made in recent times, but Europe appears to have been practically free from this superstition.

Prof. Hellmann's researches relating to the early history of meteorological questions are always very instructive; in this article he points out that at times it is not easy to draw a sharp boundary line between knowledge, belief, and superstition.

THEORIES OF ORE-GENESIS.[1]

THE subject of ore-genesis is of the greatest importance to the mining engineer, for it is evident that every forecast of the continuity of an ore-body beyond the limits of the ore in sight must, if it is not to be entirely empirical, rest on some hypothesis as to origin. This field of inquiry has since the beginning of this, and during the latter half of the past century, riveted the attention of the best mining geologists in all parts of the world. In a comparatively small interval of time, our knowledge has advanced by leaps and bounds, and many important principles governing ore-deposition have been firmly established.

It was, however, preceded by a long period, which, although fertile in suggestion and hypothesis, was not one of real progress because, contrary to the Baconian principle, "Non fingendum aut cogitandum sed inveniendum quid natura faciat aut ferat," the theories advanced were not founded on ascertained facts.

Prior to the sixteenth century the metallic contents of ore-veins were supposed to have been determined by their orientation in regard to the planets; and Agricola (1494–1555) was the first to formulate a reasonable genetic theory. Reduced to its simplest terms, Agricola's view was that ore-channels (*canales*), formed by erosion, had been filled by metallic minerals deposited from solution. These solutions, or juices (*succi*), as Agricola terms them, were waters of meteoric origin which, under the influence of heat, had taken mineral matter into solution.

From the time of Agricola to the end of the eighteenth century the mines of Saxony produced nearly all the writers on vein-formation. Such were Rösler, Becher, Henckel, Hoffmann, Zimmermann, von Oppel, von Charpentier, and von Treba.

Becher and Henckel, who wrote in the beginning

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[1] From the presidential address delivered at the Annual Meeting of the Institution of Mining and Metallurgy, on March 26, by Dr. F. H. Hatch.

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